

Modular Xenon Micro Electric Propulsion System, Phase I

Completed Technology Project (2018 - 2019)



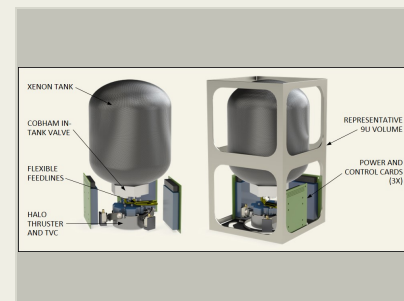
Project Introduction

While CubeSats have begun to disrupt the entire satellite industry, a lack of adequate propulsion options continues to limit their adoption beyond experimental missions. Rideshare restrictions limit CubeSats to the non-optimal orbits into which the primary mission delivers them, and often leaves them unable to maintain their orbits against drag from Earth's upper atmosphere. This restricts CubeSat utility for commercial, persistent Earth science, or interplanetary missions. ExoTerra's Modular Xenon Micro Electric Propulsion System is a high-impulse propulsion system that enables CubeSats to alter or maintain their orbits and to perform affordable, targeted science missions throughout the inner solar system. The integrated system provides 4-33 mN of thrust and 48-73 kNs of impulse at an I_{sp} from 700-1500 s using a micro-Hall Effect Thruster, and can package in 6 or 9 U of volume to meet the tight constraints of CubeSats. The propulsion system consists of the Xenon propellant and distribution system, a high efficiency PPU that is radiation tolerant to 100krad, the Halo thruster and TVC. The system achieves $>.15$ mN/Usc, >5 kNs/Up and <1.3 kg/Up.

Anticipated Benefits

Potential NASA applications include interplanetary CubeSat missions with a need for non-toxic, high impulse and thrust propulsion systems. With this capability, NASA can send CubeSat missions to the Moon, asteroids, comets, Venus, Lagrange points, or Mars. The scalability of the propellant system design makes it applicable for a wide range of spacecraft sizes and mission architectures.

A compact, reliable, affordable propellant system for SEP expands the utility of SEP for commercial satellites beyond station keeping. Exoterra's Xenon Micro Electric Propulsion System can be used for orbit raising and maintenance for commercial microsatellites. The system can also be used in an SEP-based upper stage for the burgeoning small launch vehicle market, delivering microsatellites from LEO to GEO orbit or beyond.



Modular Xenon Micro Electric Propulsion System, Phase I

Table of Contents

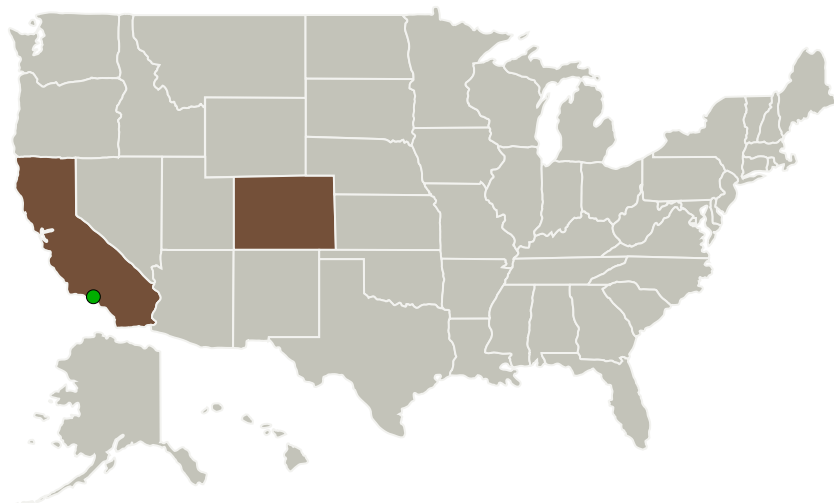
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

Modular Xenon Micro Electric Propulsion System, Phase I

Completed Technology Project (2018 - 2019)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
ExoTerra Resource, LLC	Lead Organization	Industry	Littleton, Colorado
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California	Colorado
------------	----------

Project Transitions

▶ **July 2018:** Project Start

✓ **February 2019:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141179>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ExoTerra Resource, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

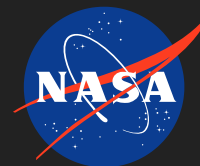
Michael Vanwoerkom

Co-Investigator:

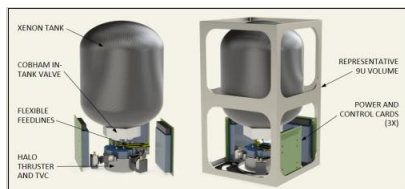
Michael Vanwoerkom

Modular Xenon Micro Electric Propulsion System, Phase I

Completed Technology Project (2018 - 2019)



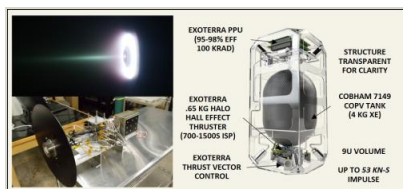
Images



Briefing Chart Image

Modular Xenon Micro Electric Propulsion System, Phase I

(<https://techport.nasa.gov/image/132774>)



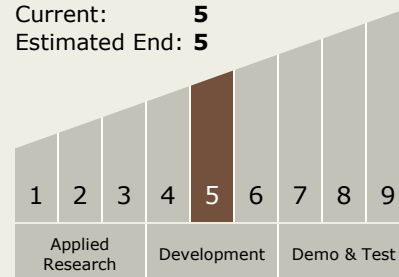
Final Summary Chart Image

Modular Xenon Micro Electric Propulsion System, Phase I

(<https://techport.nasa.gov/image/129079>)

Technology Maturity (TRL)

Start: 5
Current: 5
Estimated End: 5



Technology Areas

Primary:

- TX01 Propulsion Systems
 - TX01.2 Electric Space Propulsion
 - TX01.2.2 Electrostatic

Target Destinations

Earth, The Moon, Mars